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SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 86 Washington: 1939 No. 3056

ECHINODERMS OF THE SMITHSONIAN-HARTFORD EXPEDITION, 1937, WITH OTHER WEST INDIAN RECORDS

By Austin H. Clark

The Smithsonian-Hartford Expedition in the ship *Joseph Conrad*, made possible through the interest and generosity of George Huntington Hartford, 3d, between March 15 and May 12, 1937, visited the Bahamas, Haiti, Puerto Rico, St. Thomas, St. John, St. Croix, Saba, St. Eustatius, Dominica, Martinique, Barbados, Jamaica, and Cuba. The naturalists on this expedition were Dr. Waldo L. Schmitt, curator of the division of marine invertebrates, United States National Museum, and G. Robert Lunz, of the Charleston, S. C., Museum.

The collection of echinoderms brought back was an unusually interesting one, including excellent series of the young of various species, and no less than three new species of ophiurans, two of which were recently described by Dr. Hubert Lyman Clark. The discovery of three new ophiurans in a region so well known as the Caribbean area shows how intensively and systematically the arduous work of shore collecting in the Tropics was carried on by Dr. Schmitt and Mr. Lunz.

A list of the Smithsonian-Hartford, *Albatross*, and *Fish Hawk* stations mentioned herein is given at the end of this paper.

ASTEROIDEA

ASTROPECTEN ANTILLENSIS Lütken

Localities.—Smithsonian-Hartford station 10, Bahamas (1, E. 5428). Station 26, St. Thomas (1, E. 5580).

ASTROPECTEN ARTICULATUS (Say)

Locality.—*Albatross* station 2420, Virginia, off Cape Charles (1, 18334).

ASTROPECTEN ARTICULATUS var. VALENCIENNESI Müller and Troschel

Locality.—Texas, Clyde T. Reed (1, E. 5228).

LUIDIA CLATHRATA (Say)

Localities.—Smithsonian-Hartford station 19, Puerto Rico (arm, E. 5478). *Albatross* station 2016, Virginia, off Accomac County (1, 6372). *Albatross* station 2017, Virginia, off Accomac County (1, 6273). *Fish Hawk* station 8369, Chesapeake Bay (1, E. 1181). Texas, Clyde T. Reed (2, E. 5229).

LUIDIA SENEGALENSIS (Lamarck)

Locality.—Smithsonian-Hartford station 19, Puerto Rico (2, E. 5582).

NOTES.—Both the specimens have 9 arms. In the larger R=145 mm, and in the smaller R=70 mm.

OREASTER RETICULATUS (Linnaeus)

Locality.—Smithsonian-Hartford station 28, St. John (1, E.5415).

OPHIDIASTER GUILDINGII Gray

Locality.—Smithsonian-Hartford station 28, St. John (1, E.5453).

LINCKIA GUILDINGII Gray

Localities.—Smithsonian-Hartford station 12, Haiti (4, E.5429, E.5430, E.5447). Station 28, St. John (4, E.5432, E.5433, E.5434). Station 56, Barbados (1, E.5431). Station 68, St. Thomas (2, E.5477).

NOTES.—Two of the specimens from station 12 have 6 arms, the larger with R=80 mm. Another has 5 arms with R=80 mm. The last is a comet with 1 long arm and 5 short arms. Of the specimens from station 28 two have 6 and two have 5 arms. The specimen from station 56 and both of those from station 68 have 6 arms. Thus, of the 11 specimens collected eight have 6 and three have 5 arms.

THYRASTER SERPENTARIUS (Müller and Troschel)

Locality.—Off Tampa Bay, Fla., James E. Benedict, 1901 (1, 36995).

FREYELLA MEXICANA, new species

Characters.—Disk 11 mm in diameter; 6 stout arms only slightly swollen in the genital region, 110+ mm long; disk covered with a pavement of small plates, each with a single spinelet; genital region uniformly covered with larger plates each with usually 2 to 4 similar spinelets, more or less in a transverse series; no papulae; pedicellariae numerous on disk and arms; mouth plates large, the aboral ends of each pair separated by a small plate and supporting the large circular azygous interradial; each mouth plate with 9 to 12 spines; first two

adambulacral plates united by syzygy; proximal adambulacrals with a diagonal row of 4 or 5 spines; marginals greatly reduced, widely separated.

Description.—The disk is 11 mm in diameter, with the borders between the broad arm bases straight and only about one-quarter as long as the width of the arm bases. The surface is flat and on the same level as that of the abactinal surface of the rays, which is continuous with it.

The disk is completely covered with a pavement of small subequal contiguous polygonal plates, each of which bears a single (more rarely two) long, slender, sharp, roughened or subechinulate spinule. Thickly strewn over the surface of the disk, with a tendency to congregate about the spinules, are numerous very small pedicellariae the tips of which are much broadened, rounded-triangular, with a smooth and straight or slightly concave distal border. When the pedicellariae are open the long processes at the base of each blade extending laterally give them the appearance of having 4 blades, 2 spatulate and 2, at right angles to these, pointed.

In each of the interbrachial angles is a large, circular, swollen interradial that extends from the abactinal surface halfway to the actinal and occupies the entire interval between the arm bases. Beneath this are two large contiguous plates representing abactinal extensions of the mouth plates, which, like the interradial, span the interval between the arm bases. Immediately below the interradial is a small plate lying between the abactinal ends of the two mouth plates and with difficulty distinguishable from them.

The madreporite is rather large, 1.3 mm in diameter, situated at about its own diameter from the adjacent interradial plate, strongly convex, and bare of spines. The opening is a rather broad oval slit crossed by a few delicate calcareous bridges situated on one side.

The anus is rather large and conspicuous, excentric, 4.7 mm from the edge of the disk.

The 6 arms are 110+ mm long, stout at the base, with a rather slight fusiform swelling over the genital region, becoming slender distally. They are 3.8 mm wide at the base, 5.5 mm wide in the broadest part, about 11 mm from the disk; and the genital region, beyond which there are no abactinal plates, is 24 mm long, or a little more than twice the diameter of the disk. The arms are broad actinally, narrow abactinally, with sharply sloping sides.

The genital region is completely enclosed by a continuous pavement of rather large rhombic, pentagonal, or hexagonal contiguous plates, which are usually slightly broader than long. These plates show no indication of arrangement in transverse bands, and each bears in its central portion 1 to 4 or 5 (usually 2 to 4) well-separated spinules resembling those on the disk. On a few of the plates at the

arm base there may be as many as 6 or 7 spinules, and in the distal portion of the genital region the number is usually one. Though commonly irregularly grouped, these spinules show a tendency to become aligned in a transverse row. On the surface of the plates in the vicinity of the spinules are more or less numerous very small pedicellariae resembling those on the disk.

The delicate membrane covering the abactinal surface of the arms beyond the genital region carries numerous scattered pedicellariae resembling those on the disk. These seem to have no regular arrangement.

The actinostome is 6.3 mm in diameter. The mouth plates are triangular, with the interradial (longest) apposed sides straight, the aboral side obtusely notched, and the radial side obtusely angled where the actinostome joins the ambulacral groove. The actinostomal border bears 3 subequal slender spines. Just beyond these, at the junction of the actinostome and the ambulacral groove, is a small lobate projection of the mouth plate on which are situated 2 (rarely 3) spines, the one next to the ambulacral groove resembling the spines just noticed, the other (or others) smaller. Near the distal end of the plate on the side adjoining the ambulacral groove are 2 (rarely 3) additional spines smaller than those previously mentioned and situated at some distance from them. In about the middle of the mouth plate, halfway between the long interradial side and the opposite angle, is a large stout spine roughly twice as long as the others mentioned, and between this and the outer angle of the plate adjoining the ambulacral groove is another spine, about two-thirds its size. Near the angle between the long interradial side and the distal margin of the mouth plate there may be another small spine. All the spines are enclosed in skin sacks, which bear numerous very small pedicellariae.

The first adambulacral plates are about half again as broad as long, the second are somewhat longer than their median width, and those following increase in length, those in the genital region being somewhat longer than the width of the proximal end or slightly longer, and the outer being about twice as long as the width of the proximal end or even longer. All are strongly concave on the side toward the ambulacral groove. The ambulacral groove, which at first is rather broad, narrows distally, the adambulacrals finally meeting in the midline so that the tube feet are arranged in widely separated pairs.

The first two adambulacral plates are united by a syzygy with a small ligament mass visible halfway between the median line and the border of the ambulacral groove.

The first adambulacral plate bears a long spine, about half again as long as itself, in the median line (as viewed actinally) about one-third of the distance from the proximal to the distal end. Near the distal inner angle of the plate adjoining the ambulacral groove is a furrow spine about two-thirds the length of the plate. Between this and the large central spine, forming all together a diagonal row of 4 spines, are 2 other spines of which that nearest the furrow spine is a little smaller than the latter, and that near the median spine is larger, about half as large as the median spine.

The second adambulacral plate has a similar diagonal row of 4 spines, but the large median spine is situated slightly more distally, at or slightly beyond the middle of the ossicle.

The third adambulacral plate has a diagonal row of 5 spines of which the 3 inner are subequal, small, and slender, the next is larger and stouter, and the outermost, in the center of the plate, is half again as long and much stouter.

The fourth and fifth adambulacral plates have each a similar row of 5 spines.

On the seventh adambulacral another spine appears, a long spine half again as long as the plate situated on the outer side just at the edge of the plated abactinal covering of the arm base, and just beyond the large central spine. This spine is absent from the eighth adambulacral but occurs on the ninth and twelfth and distally on alternate adambulacrals.

On the outer adambulacrals the long central spine becomes separated from the others; the latter also become smaller, forming a diagonal line of 4 small sharp spines at the distal angle of the plate.

On the distal portion of the arm the furrow spines become reduced to three, then to two, and finally to one.

All the spines are enclosed in skin sacks, which bear numerous minute pedicellariae.

The adambulacral plates are widely spaced.

The marginals are very small, less than half as long as the adambulacrals. They adjoin the distal outer angle of an adambulacral and run distally along the edge of the ambulacral, overlapping the base of the adambulacral following for about one-third of its length. They are thus widely separated from each other.

There are no papulae on the disk or on the arms.

Type.—From *Albatross* station 2379, Gulf of Mexico (U.S.N.M. no. E.5602).

Remarks.—Heretofore the family Brisingidae was known to be represented in the Caribbean region only by *Hymenodiscus agassizii* E. Perrier, from off St. Croix and Dominica in 391–450 fathoms, and *Odinia antillensis* A. H. Clark, from off Puerto Rico in 280–340 fath-

oms. *Freyella mexicana* is the first species to be reported from the Gulf of Mexico.

Although in *Freyella mexicana* the first two adambulacrals are united by syzygy, the marginals are greatly reduced and do not bear spines, the number of spines on the mouth plates and on the adambulacrals is exceptionally large, and directly beneath the prominent interradial there is a small plate that separates the upper ends of the two mouth plates of each pair, it does not seem to me that it differs sufficiently from related species to justify the creation of a new genus for its reception.

The other 6-rayed species of *Freyella* are: *Freyella sexradiata* E. Perrier from west of northern Spain in 2,255 fathoms; *F. tuberculata* Sladen, from between the Canary and Cape Verde Islands, between Ascension Island and the African coast, and the eastern tropical Pacific in 2,222–2,400 fathoms; *F. benthophila* Sladen, from the central south Pacific in 2,550 fathoms; and *F. oligobrachia* H. L. Clark, from the eastern tropical Pacific in 2,222–2,320 fathoms. All these differ from *F. mexicana* in having the first two adambulacrals articulated instead of being united by syzygy; in having the marginals with spines, at least on alternate plates; in lacking the small unpaired interradial plate between the upper ends of the mouth plates of each pair; in having the mouth plates with 2 to 4 spines instead of 9 to 12; and in having the adambulacrals with 1 or 2 spines instead of 4 or 5.

In certain respects *Freyella mexicana* suggests *Colpaster scutigerula* Sladen, from southwest of the Canary Islands in 1,525 fathoms. In this species the first two adambulacrals are united by syzygy; the mouth plates have 6 spines, and the adambulacrals have 4 or 5 spines; and there is an unpaired plate just below the interradial plate as in *F. mexicana*, but this is much larger and separates the first adambulacral plates instead of the upper ends of the mouth plates. In *Colpaster* the plates of the disk bear stout stumps ending in 4 or 5 radiating thorns instead of spinelets as in *Freyella mexicana*.

OPHIUROIDEA

OPHIOMYXA FLACCIDA (Say)

Localities.—Smithsonian-Hartford station 12, Haiti (1, E. 5471). Station 28, St. John (2, E.5474).

HEMIPHOLIS ELONGATA (Say)

Localities.—Smithsonian-Hartford station 19, Puerto Rico (3, E.5473). Station 20, Puerto Rico (1, E.5593).

OPHIOSTIGMA ISACANTHUM (Say)

Locality.—Smithsonian-Hartford station 17, Puerto Rico (1, E.5448).

AMPHIODIA GYRASPIS H. L. Clark

Locality.—Smithsonian-Hartford station 19, Puerto Rico (4+, E.5454, E.5455, E.5456).

OPHIACTIS NOTABILIS H. L. Clark

Ophiactis notabilis H. L. Clark, Proc. U. S. Nat. Mus., vol. 86, p. 415, pl. 52, figs. 1, 2, 1939.

Locality.—Smithsonian-Hartford station 19, Puerto Rico, (1, E.5590).

OPHIACTIS SAVIGNYI (Müller and Troschel)

Locality.—Smithsonian-Hartford station 19, Puerto Rico (6, E.5451).

OPHIOTHRIX ANGULATA (Say)

Localities.—Smithsonian-Hartford station 12, Haiti (3, E.5399, E.5400, E.5401). Station 15, Haiti (1, E.5398). Station 19, Puerto Rico (7, E.5395, E.5396). Station 21, Puerto Rico (11, E.5397, E.5407, E.5416). Station 23, St. Thomas (4, E.5404, E.5405, E.5406). Station 50, Martinique (2, E.5403). Station 55, Martinique (5, E.5402).

Notes.—One of the specimens from station 12, Haiti (E.5400), is white with the radial shields, except for the outer and inner ends, violet; the arms are sprinkled with small irregular black dots, and bear interrupted light violet cross bands at about every fourth pair of side arm plates. Another specimen from station 12 (E.5401) has the disk violet with broad light lines on the outer side of the radial shields and central white marks; the upper and side arm plates are violet and white. As in the preceding specimen, there is no median line on the arms. A specimen from station 19, Puerto Rico (E.5395), has the arms with frequent narrow cross bands and no median stripe.

OPHIOTHRIX SUENSONII Lütken

Locality.—Smithsonian-Hartford station 55, Martinique (4, E.5409, E.5410, E.5411).

OPHIOTHRIX ÖRSTEDII Lütken

Localities.—Smithsonian-Hartford station 12, Haiti (11, E.5417). Station 17, Puerto Rico (1, E.5412). Station 27, St. John (1, E.5413). Station 28, St. John (1, E.5414).

OPHIOTHRIX HARTFORDI, new species

Plate 53, Figures 1, 2

Description.—The disk is 4.3 mm in diameter, flat, pentagonal, with broadly rounded interradial angles. The sides of the pentagon, crossing the arm bases, are straight or slightly concave. The greater

part of the surface of the disk is occupied by 5 pairs of large radial shields. The two shields of each pair are separated by a single somewhat irregular row of moderate-sized obscurely delimited scales. The pairs of shields are separated interradially by about 3 rows of scales with similarly indefinite borders. The scaled central portion of the disk, a circular area with a diameter equal to about one-fourth that of the disk, the narrow radial line of scales, and the broad interradial bands are uniformly studded with short, thick, subconical stumps with blunt spinulose tips that on superficial examination appear like granules. In the central circular area there are about 40 of these; a single somewhat irregular row runs along the lines of scales separating the radial shields of each pair; and there are about 3 irregular rows at the inner ends of the interradial bands of scales, this number increasing to about 6 at the edge of the disk. Each scale seems to carry a single stump. The radial shields bear 1 to 5 widely and irregularly scattered stumps. The interbrachial areas on the oral surface are naked except for 3 or 4 large, rounded, and well-defined scales in the central portion, one or two of which may bear centrally situated stumps.

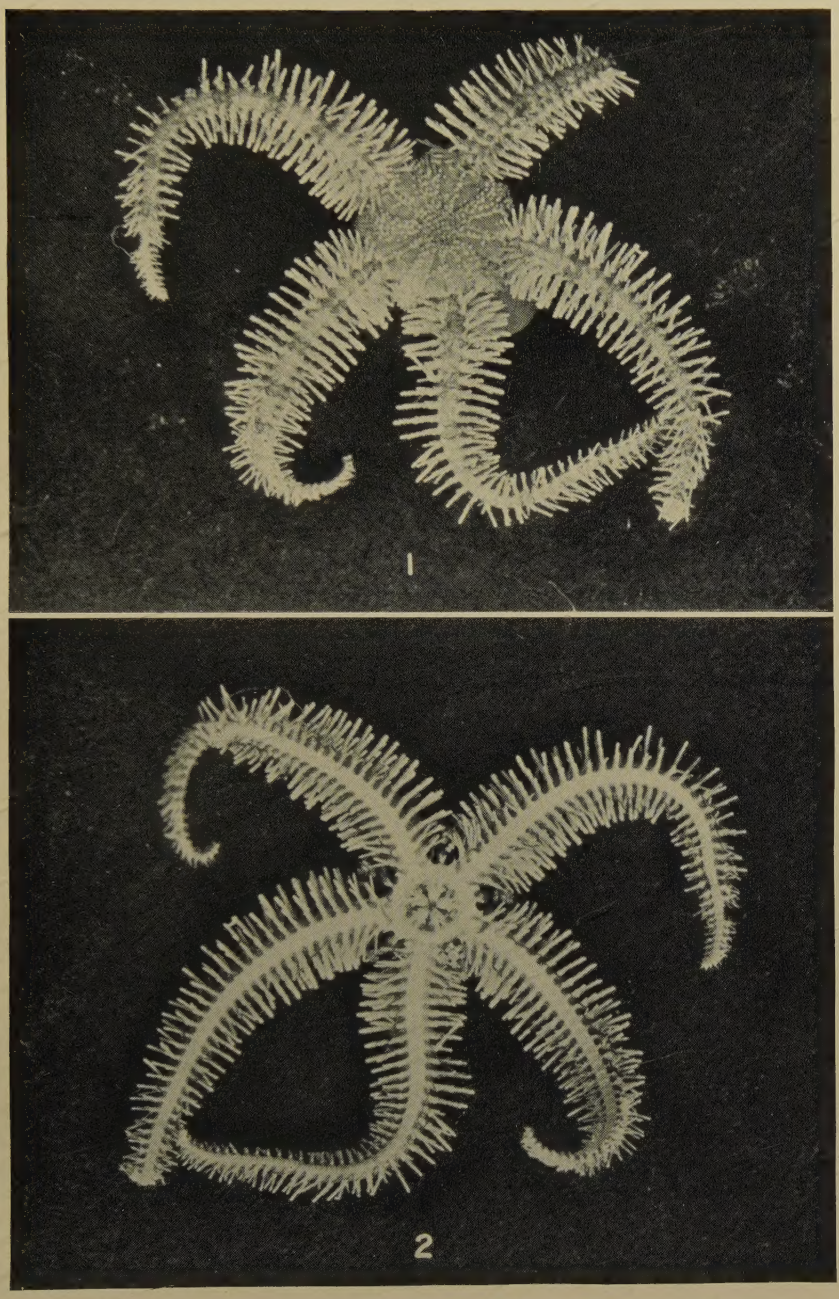
The 5 short arms are 13 mm long. The upper arm plates increase in size to the fourth, which is triangular with the proximal angle very broadly and the lateral angles more abruptly rounded, not quite twice as broad as long. The upper arm plates following gradually increase in length, the angle between the lateral edges at the same time decreasing, so that at the middle of the arm they are about as long as broad. Distally they become very narrow, elongate fan-shaped, much longer than broad, with rounded lateral angles, remaining always in contact. The surface of the upper arm plates is finely pustulate.

The oral shields are nearly twice as broad as long, rhombic with concave sides, the lateral angles rounded and the outer and inner angles pointed.

The adoral plates are triangular, about twice as long as the width of the radial ends, with their apices just meeting under the inner side of the oral shields. Their outer border is closely appressed to, and of the same length as, the adjoining side of the oral shield.

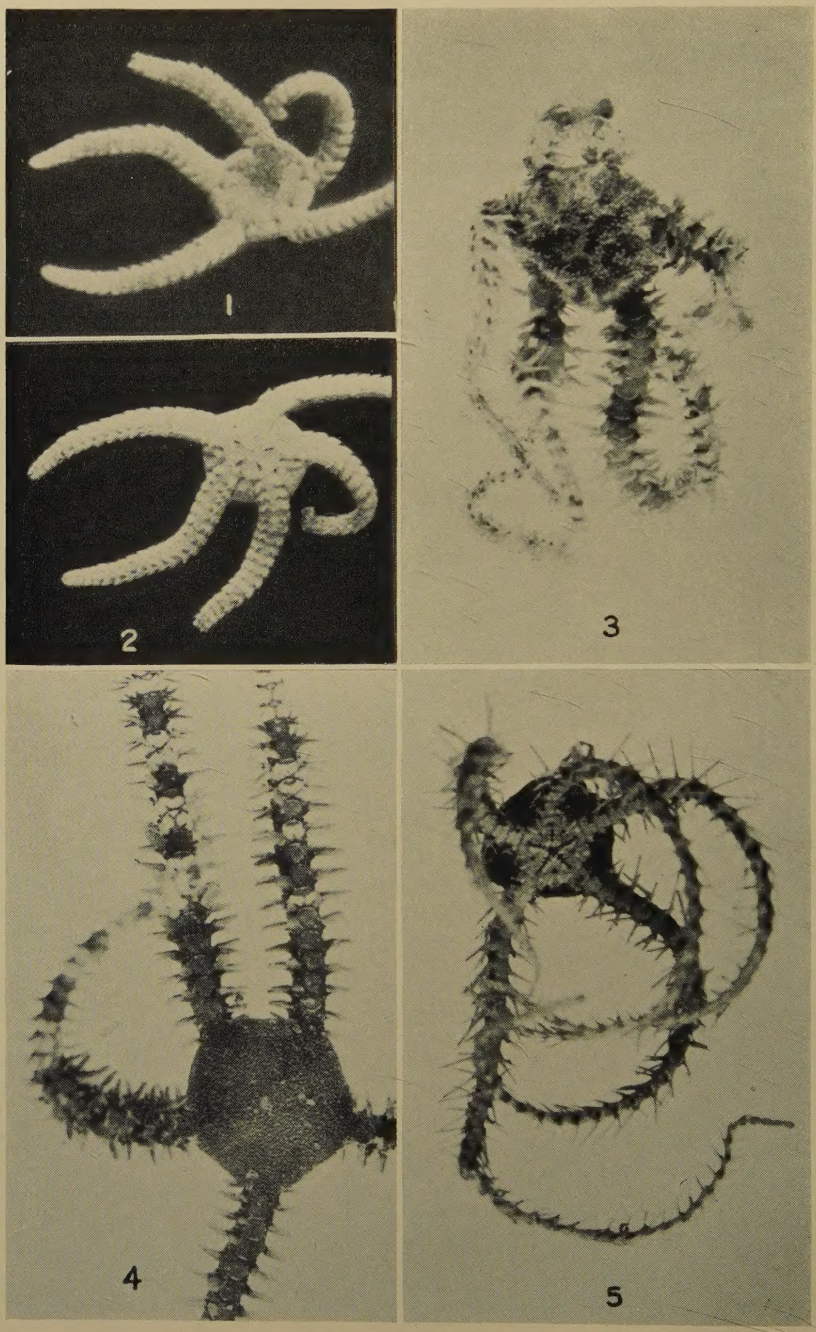
There are 9 rather short and stout tooth papillae, a column of 4 on each jaw plate and a median one.

The under arm plates are quadrilateral with the proximal and distal angles rounded, the distal border strongly concave, and the proximal somewhat convex. They are at first broader than long, becoming about as broad as long in the middle of the arm and elongate distally. In the earlier portion of the arms the proximal border is more or less angulate centrally.



OPHIOTHRIX HARTFORDI, NEW SPECIES.

The type specimen (U. S. N. M. No. E. 5592) from station 16, Puerto Rico: Aboral (1) and oral (2) views. A young individual is visible in the lower right interbrachial angle, figure 2. × 5.



OPHIODERMA AND OPHIOCOMA.

1, 2, *Ophioderma brevicaudum*, *Ophiocryptus* stage, from station 12, Haiti (U. S. N. M. No. E. 5437), aboral (1) and oral (2) views; 3, *Ophiocoma pumila*, young, from station 28, St. John (U. S. N. M. No. E. 5559), aboral view; 4, *Ophiocoma echinata*, young, from station 15, Haiti (U. S. N. M. No. E. 5514), aboral view; 5, *Ophiocoma riisei*, young with naked disk, from station 17, Puerto Rico (U. S. N. M. No. E. 5522), oral view. All × 5.

The side arm plates are widely separated on the oral side of the arms; on the aboral side they extend inward for about one-third the width of the arm. The arm spines are borne on a high narrow crest.

There are 7 arm spines. The lowest arm spine is in the form of a stout hook with a long, slender, strongly recurved glassy tip beneath which is a long and slender supplementary point. The uppermost spine is short and more or less erect. The longest spine is the third, counting from the aboral surface. The second is intermediate in length between the first and the third, usually more nearly resembling the third. Aborally the spines rapidly decrease in length. The spines are rather slender, flattened, and rather strongly echinulate. They are rather short, the longest being only about one-third again as long as the width of the arm.

The single tentacle scale, situated in the angle between the under and side arm plate, is short, rhombic, not much longer than broad, with a finely spinous and more or less rounded tip. The first tentacle scale is on the third tentacle pore.

The color is light pearl gray, the arms above with narrow bands of darker on about each fourth joint. The spines and the oral surface are white.

Type.—Smithsonian-Hartford station 16, Puerto Rico, western end of San Juan Island in the vicinity of Fort San Geronimo; shore; W. L. Schmitt, March 27, 1937 (U. S. N. M. no. E. 5592).

Notes.—The type specimen carries several young clinging to the ventral portion of the disk by means of the strongly developed hook representing the lowest arm spine. The skeleton of the young consists of a very large pentagonal central plate with a large primary radial extending outward from each of the five sides. There is a single prominent tubercle or stump in the middle of the inner border of each primary radial. From the angles of the central pentagon the sides of each radial converge to the arm base. The arms, as seen from above, consist of two upper arm plates and 2 pairs of side arm plates, and terminate abruptly in a small bud. The hook representing the lowest arm spine is well developed. Above the hook on the first side arm plate are two very short and very spiny rudiments of arm spines; there is only one of these on the second side arm plate.

OPHIOTHRIX PLATYACTIS H. L. Clark

Ophiothrix lineata A. H. Clark, Univ. Iowa Studies in Nat. Hist., vol. 9, no. 5, p. 54, 1921 (off Pelican Island, Barbados, 4 fathoms).—H. L. Clark, New York Acad. Sci., Scientific survey of Porto Rico and the Virgin Islands, vol. 16, pt. 1, p. 62, 1933 (possibly *O. suensonii*).

Ophiothrix platyactis H. L. Clark, Proc. U. S. Nat. Mus., vol. 86, p. 417, pl. 52, figs. 3, 4, 1939.

Locality.—Smithsonian-Hartford station 56, Barbados (1, E. 5591.)

OPHIONEREIS RETICULATA (Say)

Localities.—Smithsonian-Hartford station 12, Haiti (1, E.5469). Station 15, Haiti (1, E.5470).

OPHIONEREIS SQUAMULOSA (Koehler)

Locality.—Smithsonian-Hartford station 12, Haiti (3, E.5466, E.5467, E.5468).

OPHIOCOMA ECHINATA (Lamarck)

PLATE 54, FIGURE 4

Localities.—Smithsonian-Hartford station 12, Haiti (20, E.5498, E.5499, E.5500, E.5501, E.5502, E.5503, E.5504, E.5505, E.5506, E.5507, E.5508, E.5509, E.5510, E.5511). Station 15, Haiti (2, E.5513, E.5514). Station 16, Puerto Rico (2, E.5484, E.5485). Station 17, Puerto Rico (5, E.5486, E.5487, E.5488, E.5489, E.5490). Station 23, St. Thomas (5, E.5493, E.5494, E.5495, E.5496, E.5497). Station 28, St. John (17, E.5479, E.5480, E.5481, E.5482, E.5483). Station 56, Barbados (5, E.5491, E.5492).

NOTES.—In the specimen from station 17, Puerto Rico (E.5522) (pl. 54, fig. 4) has the disk 4.5 mm in diameter and the arms 16.5 mm long. In an individual of this size there are 2 tentacle-scales in the proximal half of the arm, but only one in the distal half. The aboral surface of the disk is densely covered with small spinulose granules, which are somewhat higher than thick, but there are no granules on the oral surface. Five or six of the uppermost arm spines on each side of the basal portion of the arm, situated on alternate side arm plates beginning with the third, are much swollen and stand nearly vertically. The presence of 5 arms, granules on the disk, 2 tentacles scales in the proximal half of the arm, and markedly swollen upper arm spines make the young of this species easy to recognize.

OPHIOCOMA RIISEI Lütken

PLATE 54, FIGURE 5

Localities.—Smithsonian-Hartford station 12, Haiti (4, E.5515, E.5516, E.5517). Station 17, Puerto Rico (1, E.5522). Station 28, St. John (1, E.5520). Station 66, St. Thomas (3, E.5518, E.5519, E.5521).

NOTES.—In the specimen from station 17, Puerto Rico (E.5522) (pl. 54, fig. 5), the disk is 3.5 mm in diameter and the arms are about 15 mm long. There are no granules on the disk, which, except for its very dark color, recalls the disk of an *Amphiura*. The im-

bricating disk scales are of moderate size, but the radial shields are very small, oblong with rounded ends, two to three times as long as broad, and widely separated. They are situated on either side of the arm bases, and the two of each pair diverge inwardly. The lateral border of the disk between the arm bases is sharply keeled. The first tentacle pore carries 1, rarely 2, tentacle scales; those following have one only. The first side arm plate carries 2 arm spines, the second carries 3, and the third usually has 4; there are 3 arm spines on the side arm plates succeeding as far as the middle of the arm, beyond which the number drops to 2, with an occasional 3. In the proximal portion of the arm the uppermost arm spine is equal in length to about two arm joints, the lowest to one, with the middle arm spine intermediate. The arm spines are very slender. As the arm joints become longer distally the arm spines decrease in relative length, the upper soon equaling one and one-half arm joints with the lower somewhat shorter. Later the upper is only slightly longer than an arm joint. In the distal portion of the arm the two arm spines are of the same length, about as long as an arm joint. Terminally the upper arm spine decreases in length, finally becoming only about two-thirds the length of the lower. In color the disk is dark brown, the arms above light brown, the circumoral structures, spines, and lower surface of the arms white or slightly yellowish white. The naked disk and long and very slender arm spines easily distinguish the young of this species from the young of *O. echinata* and of *O. pumila*.

OPHIOCOMA PUMILA Lütken

PLATE 54, FIGURE 3

Localities.—Smithsonian-Hartford station 12, Haiti (33, E. 5526 to E. 5558). Station 16, Puerto Rico (1, E. 5560). Station 23, St. Thomas (2, E. 5563, E. 5564). Station 28, St. John (1, E. 5559). Station 56, Barbados (2, E. 5561, E. 5562).

NOTES.—The specimen from station 28, St. John (E. 5559) (pl. 54, fig. 3), has the disk 4 mm in diameter and the arms about 13 mm long. There are 6 arms, the 3 on one side slightly larger than the 3 on the other side. The granules aborally are high, twice as high as thick or higher, swollen-conical, and somewhat less densely placed than in larger examples. There are 4 arm spines until near the end of the arms, where the number falls to 3. Except for the possession of 6 arms, the young of this species more closely resemble the fully grown than do the young of *O. echinata* or *O. riisei*. The occurrence in this individual of two groups of 3 arms of different sizes suggests that autotomy may take place at least twice before the ultimate 5-armed stage is reached.

OPHIOPSILA RIISEI Lütken

Locality.—Smithsonian-Hartford station 12, Haiti (6, E. 5460 to E. 5465).

OPHIODERMA APPRESSUM (Say)

Localities.—Smithsonian-Hartford station 12, Haiti (1, E. 5419). Station 17, Puerto Rico (1, E. 5418). Station 27, St. John (1, E. 5425). Station 28, St. John (6, E. 5422 to E. 5424). Station 56, Barbados (1, E. 5420). Station 66, St. Thomas (1, E. 5421).

OPHIODERMA BREVICAUDUM Lütken

PLATE 54, FIGURES 1, 2

Localities.—Smithsonian-Hartford station 3, Bahamas (1, E. 5443). Station 12, Haiti (10, E. 5437, E. 5439, E. 5440). Station 15, Haiti (1, E. 5438). Station 17, Puerto Rico (5, E. 5441, E. 5445). Station 23, St. Thomas (1, E. 5442). Station 28, St. John (1, E. 5444). Station 33, St. Croix (1, E. 5436). Station 56, Barbados (2, E. 5435).

NOTES.—One of the specimens from station 12, Haiti (E. 5437) (pl. 54, figs. 1, 2), is in the *Ophiocryptus* stage. The disk is 2.7 mm in diameter and the arms are 5 mm long. The entire upper and under surface is uniformly covered with granules from which the mouth papillae and the short conical arm spines project. On some of the arms more or fewer of the upper arm plates show raised areas of various sizes bare of granules indicating the beginning of the transition to the adult form. The lateral areas between the arm bases are occupied by a single large somewhat swollen plate evenly covered, like the rest of both surfaces, with closely set granules. The color is uniform light and somewhat grayish green, lighter on the oral side.

OPHIODERMA CINEREUM Müller and Troschel

Locality.—Smithsonian-Hartford station 16, Puerto Rico (1, E. 5427).

OPHIODERMA RUBICUNDUM Lütken

Locality.—Smithsonian-Hartford station 68, St. Thomas (1, E. 5577).

OPHIOZONA IMPRESSA (Lütken)

Locality.—Smithsonian-Hartford station 4, Bahamas (E. 5472).

OPHIOLEPIS ELEGANS Lütken

Locality.—Smithsonian-Hartford station 55, Martinique (4, E. 5458, E. 5459).

OPHIOLEPIS PAUCISPINA (Say)

Localities.—Smithsonian-Hartford station 12, Haiti (1, E. 5475). Station 23, St. Thomas (1, E. 5457).

ECHINOIDEA

EUCIDARIS TRIBULOIDES (Lamarck)

Localities.—Smithsonian-Hartford station 3, Bahamas (1, E. 5586). Station 12, Haiti (6, E. 5578).

CENTRECHINUS ANTILLARUM (Philippi)

Localities.—Smithsonian-Hartford station 12, Haiti (1, E. 5452). Station 20, Puerto Rico (1, E. 5583).

NOTES.—The specimen from station 12 is small, with banded dark brown and white spines. In life the large specimen from station 20 was reddish, with pure white spines.

LYTECHINUS VARIEGATUS (Leske)

Localities.—Smithsonian-Hartford station 4, Bahamas (3, E. 5596). Station 20, Puerto Rico (1, E. 5584). Station 26, St. Thomas (6, E. 5579). Station 28, St. John (1, E. 5525).

NOTES.—The specimens from station 4 are 5–9 mm in diameter and white in color. The specimen from station 20 is white, with the spines in the 10 poriferous zones green; a narrow wavy red line runs down the middle of each interambulacrum. The largest specimen from station 26 is 76 mm in diameter.

TRIPNEUSTES ESCULENTUS (Leske)

Localities.—Smithsonian-Hartford station 3, Bahamas (3, E. 5585). Station 28, St. John (1, E. 5524). Station 33, St. Croix (3, E. 5523). Station 66, St. Thomas (2, E. 5588).

ECHINOMETRA LUCUNTER (Linnaeus)

Localities.—Smithsonian-Hartford station 9, Bahamas (3, E. 5383). Station 12, Haiti (31, E. 5389, E. 5390, E. 5391, E. 5426, E. 5446). Station 15, Haiti (1, E. 5408). Station 16, Puerto Rico (1, E. 5394). Station 17, Puerto Rico (5, E. 5392, E. 5393). Station 28, St. John (7, E, 5384, E. 5385, E. 5386). Station 38, St. Croix (1, E. 5575). Station 66, St. Thomas (2, E. 5387, E. 5388).

NOTES.—The specimens are all small, the smallest having a diameter of 3.4 mm (station 12, Haiti, E. 5389). In the smallest specimens the spines are whitish or light greenish with white tips and are conspicuously banded, having either one dark band just beyond the middle, or two dark bands at about the ends of the first and second thirds.

In the larger specimens the spines are usually dark brownish with an olive tinge, less commonly with a violet tinge. Rarely they are light drab, and occasionally they are more or less bright light olive

with abrupt and conspicuous deep violet tips (station 12, Haiti, E. 5391; station 28, St. John, E. 5384, E. 5386).

The spines vary somewhat in length, the longest sometimes almost equaling the lesser diameter of the test (station 28, St. John, E. 5385), though usually they are considerably shorter. Occasionally they are slender (station 28, St. John, E. 5385), and in one specimen (station 17, Puerto Rico, E. 5393) they are swollen and club-shaped—possibly a pathological condition.

CLYPEASTER ROSACEUS (Linnaeus)

Localities.—Smithsonian-Hartford station 3, Bahamas (1, E. 5587). Station 4, Bahamas (1, E. 5595).

NOTES.—The specimen from station 4 is small, 15.5 mm long and 13 mm broad.

MELLITA QUINQUIESPERFORATA (Leske)

Localities.—Cherrystone, Va., Col. Marshall McDonald, August 27, 1881 (60+, 4980, 5493, 30901). Hog Island, Virginia, William Stimpson (1, 3531). Smiths Island, Virginia, William Palmer, May 19, 1898 (1, 18974). Wallops Island, Virginia, A. A. Riggin (2, 32310).

NOTES.—Living examples of this species are very abundant at Cherrystone, Va., and are common locally at Smiths Island.

ECHINONEUS CYCLOSTOMUS Leske

Localities.—Smithsonian-Hartford station 4, Bahamas (74, E. 5594). Station 12, Haiti (9, E. 5476). Station 29, St. John (2, E. 5449, E. 5450).

NOTES.—The specimens from station 4 are 3–12 mm in length, mostly very small.

MOIRA ATROPOS (Lamarck)

Locality.—Smithsonian-Hartford station 26, St. Thomas (1, E. 5581).

BRISSOPSIS ATLANTICA Mortensen

Locality.—Smithsonian-Hartford station 4, Bahamas (1, E. 5597).

NOTES.—This specimen is very small, 7.5 mm long by 6.7 mm broad.

HOLOTHUROIDEA

HOLOTHURIA GLABERRIMA Selenka

Localities.—Smithsonian-Hartford station 15, Haiti (2, E. 5566). Station 16, Puerto Rico (2, E. 5568). Station 27, St. John (1, E. 5574). Station 33, St. Croix (3, E. 5567). Station 37, St. Croix (1, E. 5569).

HOLOTHURIA IMPATIENS Forskål

Locality.—Smithsonian-Hartford station 28, St. John (6, E. 5570).

HOLOTHURIA SURINAMENSIS Ludwig

Locality.—Smithsonian-Hartford station 28, St. John (1, E. 5572).

STICHOPUS BADIONOTUS Selenka

Locality.—Smithsonian-Hartford station 28, St. John (1, E. 5573).

THYONE COGNATA (Lampert)

Locality.—Smithsonian-Hartford station 15, Haiti (1, E. 5565).

PENTACTA PYGMAEUS Théel

Locality.—Smithsonian-Hartford station 19, Puerto Rico (9, E. 5571).

LOCALITIES GIVEN IN THE PRECEDING LIST

STATIONS OF THE SMITHSONIAN-HARTFORD EXPEDITION, 1937

Station 3. Bahamas. Nassau Harbor, west end of Atholl Island; March 15.

Station 4. Bahamas. Nassau Harbor, off the south side of Hog Island, halfway between east end and anchorage; bottom coral sand with *Centrechinus;* March 16.

Station 9. Bahamas. San Salvador (Watling Island), rocky point about 2 miles south of Cockburn Town; March 19.

Station 10. Bahamas. San Salvador (Watling Island), vicinity of anchorage, Cockburn Town, 4½–10 fathoms; white-sand bottom; March 19.

Station 12. Haiti. Tortuga Island, reef to east side of Tierra Baja road; 3 feet; scattered coral heads with turtle grass and *Centrechinus*; March 21.

Station 15. Haiti. Cape Haitien, near Dames Point; March 22.

Station 16. Puerto Rico. West end of San Juan Island, in the vicinity of Fort San Geronimo; March 27.

Station 17. Puerto Rico. West end of San Juan Island, in the vicinity of Fort San Geronimo; March 28.

Station 19. Puerto Rico. Off Puntilla Point, parallel to Tablazo Shoal; 3.5 fathoms; bottom broken shell, broken coral, and mud; March 29.

Station 20. Puerto Rico. Off west shore of San Juan harbor, in line with and west of preceding markers (station 19); bottom hard sandy mud, worm tubes, and coral rocks; March 29.

Station 21. Puerto Rico. Mangrove swamp and along peaty shore halfway between airport landing and bridge crossing the lower end of San Juan harbor; March 29.

Station 23. St. Thomas, Virgin Islands. Charlotte Amalia, east shore of harbor, seaward side of coal dock; April 4.

Station 26. St. Thomas, Virgin Islands. Charlotte Amalia, between ships' anchorage and revenue cutter dock; 8–20 feet; sandy bottom; April 5.

Station 27. St. John, Virgin Islands. Coral Harbor, east shore, Hurricane Hole; shingle beach and weed-grown rocks; April 6.

Station 28. St. John, Virgin Islands. West side of Coral Bay, coral reef off Lagoon Point; April 6.

Station 29. St. John, Virgin Islands. Little Cruz Bay, anchorage; 4 fathoms; April 6.

Station 33. St. Croix, Virgin Islands. Judith Fancy Bay; April 9.

Station 37. St. Croix, Virgin Islands. Mangrove Island, Salt River lagoon; April 10.

Station 38. St. Croix, Virgin Islands. North side of Buck Island; April 10.

Station 50. Martinique. Fort-de-France, shore north of fort and east of anchorage; April 15.

Station 55. Martinique. Fort-de-France, about 1 to 2,000 yards off the south shore of the harbor; 8–10 fathoms; almost wholly sponge bottom; April 17.

Station 56. Barbados. Carlisle Bay, north and northeast end of Pelican Island; under rocks and cracked from old coral; April 19.

Station 66. St. Thomas, Virgin Islands. Banana Bay, Water Island; April 24.

Station 68. St. Thomas, Virgin Islands. Smith Bay, reef and beach; April 25.

"ALBATROSS" STATIONS

Station 2016. Off the Eastern Shore of Virginia (lat. 37°31′00″ N., long. 74°52′36″ W.); 19 fathoms; fine sand and shells; May 5, 1883.

Station 2017. Off the Eastern Shore of Virginia (lat. 37°30′48″ N., long. 74°51′24″ W.); 18 fathoms; fine sand and shells; May 5, 1883.

Station 2379. Gulf of Mexico, south of Mobile, Ala. (lat. 28°00′15″ N., long. 87°42′00″ W.); 1,467 fathoms; yellow ooze; March 2, 1885.

Station 2420. Off the mouth of Chesapeake Bay (lat. 37°03′20″ N., long. 74°31′40″ W.); 104 fathoms; black sand, mud, and gravel; April 5, 1885.

"FISH HAWK" STATION

Station 8369. Mouth of Chesapeake Bay (lat. 36°59′55″ N., long. 76°00′42″ W.); 7.5 fathoms; hard fine gray sand; October 3, 1915.

U. S. GOVERNMENT PRINTING OFFICE: 1939